

2018 Annual Water Report



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1.0 Introduction

This report provides information such as explanation of water source, water test results, maintenance programs and improvements to the water system. This is a requirement under the City of Parksville operating conditions, shown in Appendix G.

This report has been submitted to Island Health and is available on the City of Parksville website at www.parksville.ca [City Hall/Departments/Operations/Water].

2.0 Parksville Water System

The City of Parksville has about 5,000 water connections serving over 12,500 permanent as well as seasonal residents and also supplying water to the Regional District of Nanaimo (Nanosee Bay Peninsula system) in the summer months.

These users get their drinking water from three sources.

- Englishman River
- Springwood Well Field
- Railway Well Field

The water is treated using either liquid or gaseous chlorine and stored in four reservoirs at both ends of the City.



Water Treatment Plant
Construction—Intake December 2018

2.1 Groundwater Wells

The City's groundwater is pumped from a confined quadra sands aquifer that runs underground alongside the railway tracks from Trill Drive to the City's boundary in the southwest. The City currently has 16 production wells ranging from 2.0 l/s (25.23 IGPM) to 8.6 l/s (113.5 IGPM). See **Appendix A** for well locations.

Well Name	Pump intake (m)	Production (l/s)
Springwood Well #1	22.8	1.6
Springwood Well #3	30.36	3.9
Springwood Well #5	30.52	4.2
Springwood Well #6	31.8	3.8
Springwood Well #7	22.35	9.3
Springwood Well #8	23.71	8.1
Springwood Well #9	Under construction	Under construction
Springwood Well #10	32.18	3.3
Springwood Well #11	30.42	2.8
Railway Well#1	35	4.7
Railway Well#2	34.15	5.6
Railway Well#3	38.46	2.4
Railway Well#4	35.67	3.0
Railway Well#5	36	5.3
Railway Well#6	35	2.3
Railway Well#7	35	4.8
Railway Well #8	35.68	3.2
Industrial Well#8	-	-

Pump Depth and Production Information

2.2 River Intake

Between the end of April and mid October, the City pumped 1,088,785 m³ of water from the Englishman River to keep up with summer demands. The water in the Englishman River is partially supplied from the Arrowsmith Dam. The Ministry of Environment, Fisheries and the Arrowsmith Water Service (AWS) developed an operating rule curve in an effort to conserve reservoir storage water for critical fisheries rearing periods. A minimum flow is released into the river based on this curve between June and October .



A new intake was completed in 2017, the transmission mains and the pump station were completed in 2018 and the water treatment plant will be completed late 2019.

2.3 Arrowsmith Dam

The City of Parksville, the Regional District of Nanaimo, and the Town of Qualicum are partners in the Arrowsmith Water Service (AWS). A concrete gravity dam located at Arrowsmith Lake about nineteen km south of Parksville, was commissioned in 2000. The dam has a capacity of 9,000,000 m³ and is operated and maintained by the City of Parksville utilities staff. Water is released to the Englishman River through two pipes, a 900 mm and a 600 mm with flows and lake levels monitored by the City's Supervisory Control and Data Acquisition (SCADA) system.

See **Appendix B** for Arrowsmith Dam Lakes Levels 2018.

2.4 Reservoirs

Water which has been pumped either from the ground or from the river is stored in four reservoirs. Reservoirs numbers 1, 2 and 4 are located in the Springwood Water Complex on Despard Road. These three are concrete with two being partially below ground and one above. Storage capacities are:

- Reservoir #1 - 616 m³ (135,500 Imp. gal).
- Reservoir #2 - 2023 m³ (445,000 Imp. gal).
- Reservoir #4 - 4559 m³ (1,000,000 Imp. gal).

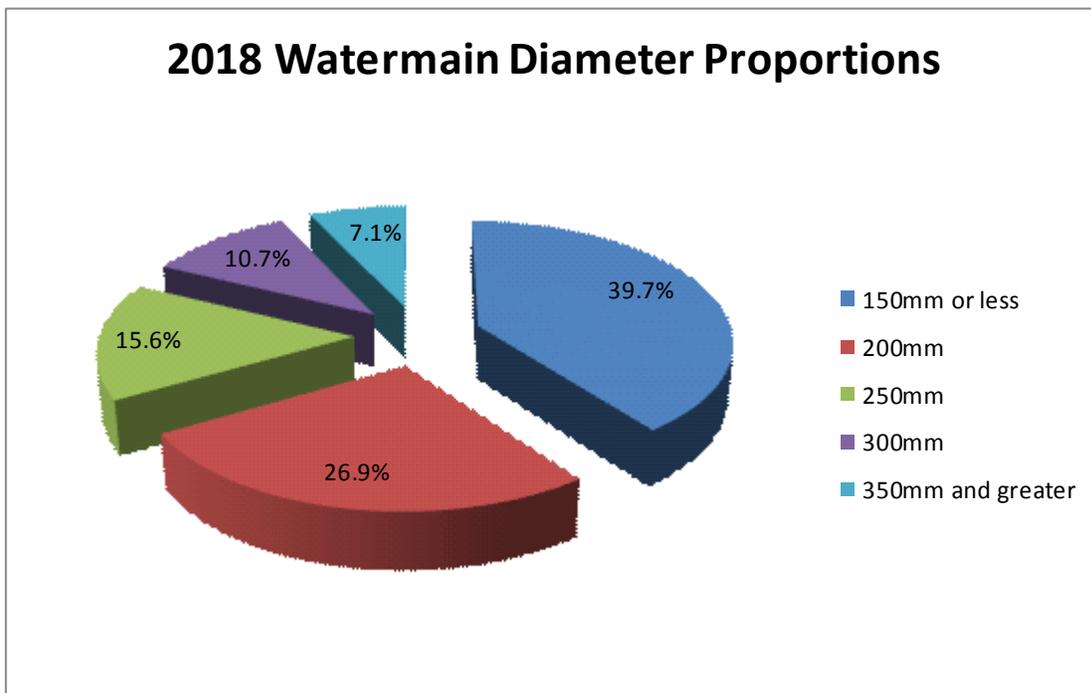
There are two additional reservoirs in the Top Bridge Park area, numbers 3 and 5. Reservoir #5 is a glass fused steel tank, Reservoir #3 is a steel tank although currently not in use. Storage capacities are:

- Reservoir #3 - 671m³ (148,000 Imp. gal) - Not in use.
- Reservoir #5 - 4300 m³ (950,000 Imp. gal).

3.0 Distribution System

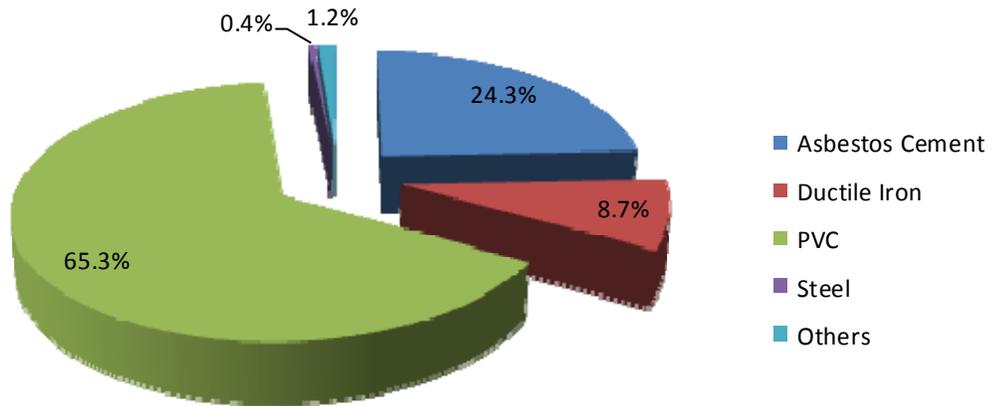
The distribution system consists of 68.5 km of PVC pipe, 9.1 km of Ductile Iron pipe and 25.5 km of AC (Asbestos Cement) pipe. Sizes range from 100 mm (4") to 400 mm (16"). There are about 600 fire hydrants and one pressure reducing valve (PRV).

Like all municipalities, the infrastructure is aging and watermains are being replaced through capital improvements and development. The following shows the size, age and material of the mains in the Parksville Water System in 2018. Some of these pipes have been replaced over the past year but newer data sometimes takes a few months to be updated by the engineering department.



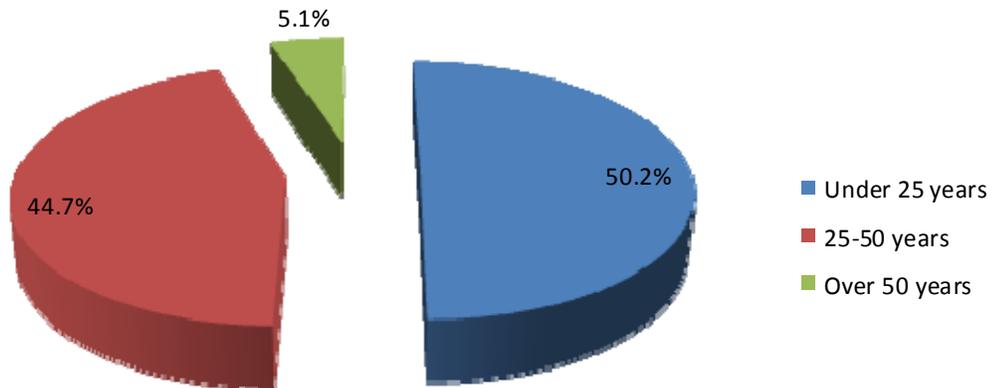
2018 Watermain Diameter Proportions				
Diameter	No Pipes	Distance (km)	Percentage	Type
150 mm or less	685	41.6	39.73%	Distribution Mains 66.67%
200 mm	550	28.2	26.93%	
250 mm	270	16.3	15.57%	Supply Mains 33.33%
300 mm	200	11.2	10.70%	
350 mm and greater	110	7.4	7.07%	
Total:	1815	=	104.7 km	

2018 Watermain Material Proportions



2018 Watermain Material Proportions		
Material Types	Distance (km)	Percentage
Asbestos Cement	25.54	24.34%
Ductile Iron	9.09	8.67%
PVC	68.54	65.33%
Steel	0.44	0.42%
Others	1.30	1.24%
Total:	104.92	km

2018 Watermain Age Proportions



2018 Watermain Age Proportions			
Age	No Pipes	Distance (km)	Percentage
Under 25 Years (≥ 1993)	1078	52.08	50.2%
25 - 50 Years (1968 - 1993)	613	46.45	44.7%
Over 50 Years (< 1968)	71	5.28	5.1%
Total:	1762	103.84	km

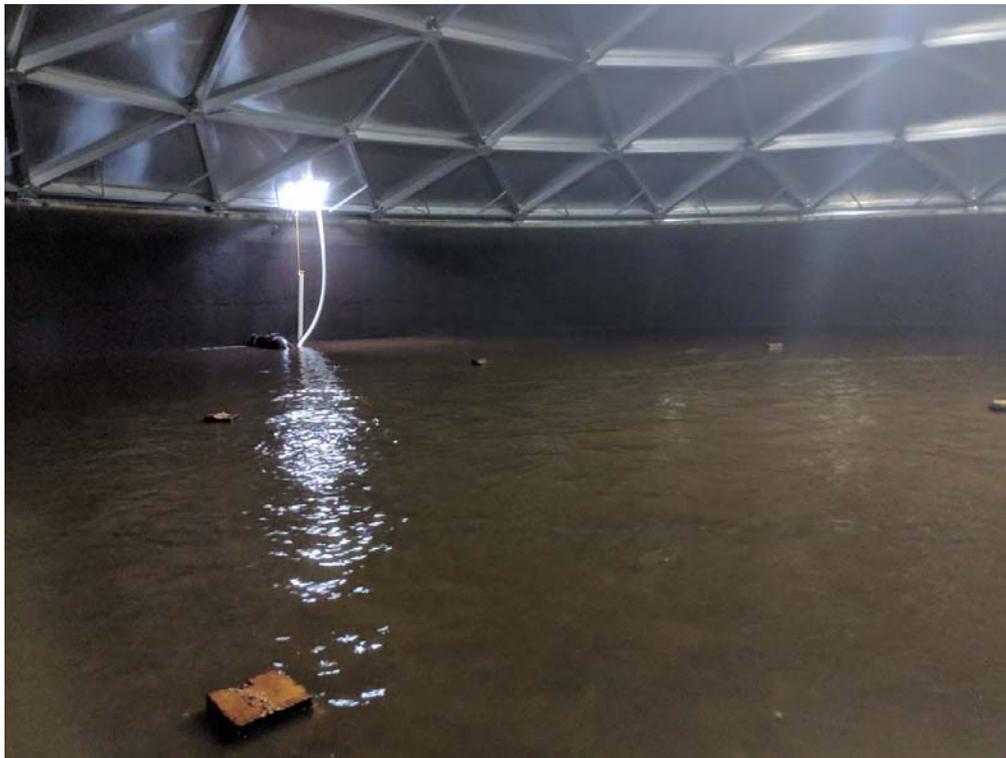
3.1 *Pressure Zones*

The City is divided into two pressure zones; low pressure and high pressure. The low pressure is a gravity-fed system based on the elevation of Reservoir #4 and Reservoir #5. A top water level of 73.74 m above sea level (geodetic) gives a range of 55 psi to 85 psi throughout the system, depending on the geographic location.

The high pressure system was initially developed for higher elevation regions of the City which do not have sufficient pressures or flows to meet firefighting flows. This high pressure zone has been expanded to areas furthest from the pump stations that lose pressure and flow due to line losses. In order to maintain a balance between high and low pressures but still keep a safe pressure in the lower areas, a PRV was installed to drop the pressure from 80 psi to 60 psi.

The high pressure water in this zone is supplied from four pumps, a 15 hp, two 40 hp and a 100 hp. These pumps are controlled through the SCADA system which automatically watches flows and switches on however many pumps it needs to meet the flow requirements.

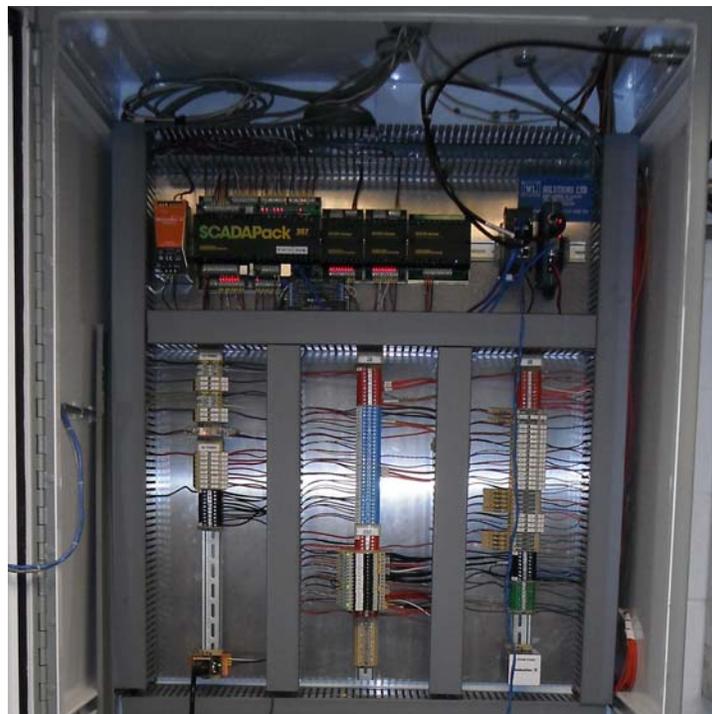
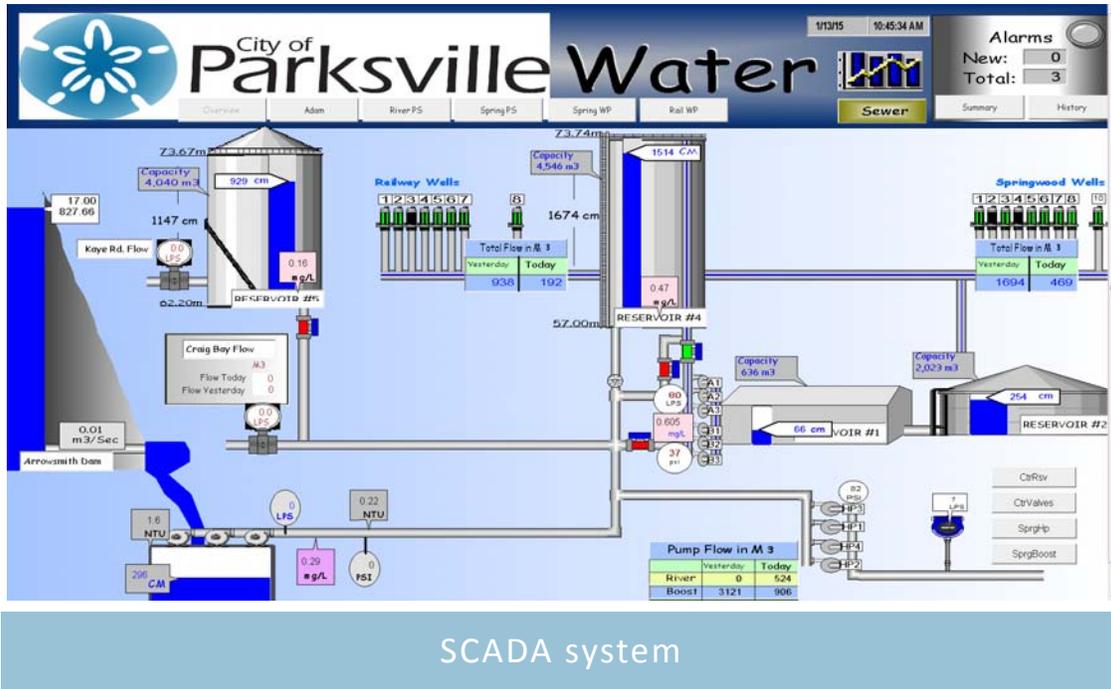
See **Appendix C** for Map of Pressure Zone Boundaries.



Springwood Reservoir #2 during cleaning

4.0 SCADA (Supervisory Control and Data Acquisition)

The water system and sewer pump stations are controlled by a computerized control system called SCADA. This system allows the operators to monitor reservoir levels, the status and flows of pumps, and monitor chlorine residuals. The operator can change set points and monitor the system remotely. Alarms are automatically called out to City staff who monitor the system 24 hours a day, 7 days a week.



5.0 Water Sampling and Testing

5.1 Bacteriological

As required by the Island Health, City staff takes bacteriological samples from 16 test ports every month to be tested for total coliforms and e-coli bacteria. There are 17 dedicated sampling sites throughout the City, only one is currently not used for testing.

See **Appendix D** for 2018 test results (L1 means Less than 1 - no detectable bacteria - Acceptable).

For a detailed list of water samples: <https://www.islandhealth.ca/learn-about-health/drinking-water/water-sampling-results>

5.2 Full Spectrum Analysis

In addition to monthly sampling throughout the distribution system, the City also sent samples for a full spectrum analysis in August 2018. As seen in Appendix E, parameters such as metals (iron, manganese) conventional parameters (pH, turbidity, hardness) and disinfection byproducts (Trihalomethane) are tested.

The source water is aesthetically acceptable as set by the "Guidelines for Canadian Drinking Water Summary Table". Aesthetic qualities apply to certain substances or characteristics such as high iron content which will stain fixtures red or manganese which will stain black.

Hardness in the water comes from calcium carbonate (CaCO_3). The river water is considered "soft" under the guidelines and the well water is "moderate". Hardness levels above 500 mg/l are normally considered unacceptable.

All parameters meet Canadian Drinking Water Guidelines.

See **Appendix E** for the 2018 Full Spectrum Analysis of the Parksville Water System Source Water. Note: the water tested is in its raw form before any type of treatment.

5.3 Trihalomethane Analyses

The City also take Trihalomethanes (THMs) samples four times per year. THMs are disinfection by-products that form when chlorine is added to water containing elevated levels of natural organic matter.



1116 Herring Gull
Way sampling site

6.0 *Water Quality Complaints and Incidents*

The operations department had few water quality complaints throughout 2018. During watermain flushing and fire hydrant maintenance there were a few calls related to “brown or dirty” water. City of Parksville crews would either re-flush the mains through a hydrant or a flushout at a location closest to the dead end or advise the homeowner to run an outside tap for a few minutes to clear up the problem.

There were a couple of complaints about the taste of chlorine in the water. Chlorine residuals are tested weekly throughout the system and are kept at a safe level. Besides recommending a filter to remove the chlorine within the home, not much can be done.

There were a few hardness related complaints, mostly contributed to new homeowners from other municipalities who are used to different water composition. There were also a few calls concerning buildup in washing machines and toilet bowls although the water is only considered “moderately hard” on the hardness scale. This rating drops throughout the summer when the river supply (soft water) is mixed with the well supply.

Many of the complaints were related to pressure drop. The cause for most of the pressure drop complaints were from a faulty PRV (responsibility of the homeowner). There was the odd occasion where staff had to flush the line in order to clear debris (from construction) or where the setter needed to be replaced.

Many calls were related to water leaks. Most were regarding leaky services or water meters. There were a couple of main breaks caused by contractors in 2018.

Clay Bank at Englishman River



7.0 *Englishman River Water Service*

The Englishman River Water Service is a joint venture between the City of Parksville and the Regional District of Nanaimo, formed to secure a bulk water supply from the Englishman River. This regional partnership supplements existing well supply sources owned and operated by the City of Parksville and Nanoose Bay Peninsula Water Service Area.

Englishman River Water Service joint venture agreement (percentages of interest).

- City of Parksville 74%
- Regional District of Nanaimo 26%

ERWS project

The City of Parksville and the Regional District of Nanaimo (Nanoose Bay Peninsula) are in the process of expanding the drinking water supply which will ensure a safe and secure water system for the community. The Englishman River Water Service project should be complete in late 2019.

Construction of the ERWS project which started in 2017 includes:

- An in-river water supply intake designed and located to consider the needs of the river users and protect aquatic habitat.
- Water treatment plant with a minimum of 16 million litres per day of membrane filtration capacity to comply with new water regulatory treatment standards including UV light and chlorine disinfection.
- Transmission supply mains to the Top Bridge and Springwood reservoirs and the Nanoose Bay Peninsula Water Service area.

To date, project contractors have completed the following:

- Transmission main
- Intake
- Pump station

For more information visit www.englishmanriverwaterservice.ca



8.0 Routine Maintenance Program

8.1 Distribution

- Watermains are flushed using a unidirectional flushing program
- Air relief valves are cleaned
- Fire line meters are cleaned
- Fire hydrants are completely disassembled and inspected on a two-year rotation
- Paint and brush out around hydrants as needed
- All irrigation backflow prevention devices tested and repaired if needed

8.2 Wells

- Daily security check of all wells
- Rehabilitation of one to two wells per year
- Pumps and motors replaced as necessary
- Filling chlorine tank on Springwood Well #1 as needed
- Annual water sampling

8.3 River Intake

- Winter maintenance of chlorination system while offline
- Weekly blowing of air lines through intake screens
- Daily checks of pump flows and chlorine levels
- Monthly calibration of turbidity analyzers

8.4 Reservoirs

- Daily security check of tanks and compounds
- Yearly cleaning of Reservoir #1 and 2
- Clean Reservoir #4 and 5 using divers every five years
- Sustaining valves cleaned monthly

8.5 Pump Stations

- Daily checks of pumps and chlorination system
- Security checks of compounds
- Bi-annual calibration of chlorine analyzers and turbidimeters

9.0 2018 Projects & Improvements

- Completed the construction of the pump station.
- Finished the construction of the transmission main.
- Progress with the water treatment plant building.
- Continued to replace 3/4" water meter.
- Replacement of Springwood well #5.
- Continued to update the water meter route maps.
- Developments that included watermain replacement or installation includes 180 Jensen Avenue and 1250 Arbutus Road.

10.0 2018 Capital Projects

- Corfield Street upgrade completed.
- Unidirectional flushing maps completed.

11.0 2019 Projects & Improvements

- Continuing to replace aging watermains for better distribution (Moss, Wallis and McKinnon).
- Finish design for upgrades to Pym Street from Forsyth Ave to Humphrey Rd.
- Start design of Hirst Ave and Memorial Ave (downtown).
- Developments that may have substantial completion in 2019 include 422 Church Road, 180 Jensen Ave. E., 572 & 540 Temple (Duggan Lane), 233 Shelly Road, 1250 Arbutus Road, Avalon Subdivision on Island Highway,
- Continue working on the cross connection control program. The program will slow down in 2019 due to the construction of the Water Treatment plant.
- Railway well #1 rehabilitation.
- Continue with water meter replacement program.
- Install cameras at Reservoir #5.



Sodium Hypochlorite tank

12.0 *Cross Connection Control Program*

In 2006, the City of Parksville drafted a cross connection control program. Due to shortage of staff, the program was not able to be properly conducted until 2014.

The cross connection program is currently addressing medium and high hazard water use. These include Industrial, Commercial and Institutional (ICI) users. Each ICI user will be assessed as to the potential risk to the water system. Any costs associated with installation, replacement and testing of an approved backflow device will have to be covered by the property owner.



Irrigation cross connection

A tracking program called FAST is used to track devices around the City (both City-owned and privately-owned devices). Property owners are required to send the annual test to the utilities technician at the City of Parksville.

City staff remains watchful of potential cross connections around the City and problems are reported to the utilities technician. During 2019, the program will slow due to staff training for the water treatment plant.

13.0 *Emergency Response Plan*

The City of Parksville has an Emergency Response Plan (ERP) pertaining to the water system. This document outlines the strategies to deal with events such as contamination of water supply, pump failures and turbidity events. This plan is updated annually and a separate ERP exists for the Arrowsmith Dam (DERP).

The ERP is currently going through major changes due to the upcoming water treatment plant.



Flooding at the River Station
(Englishman River)

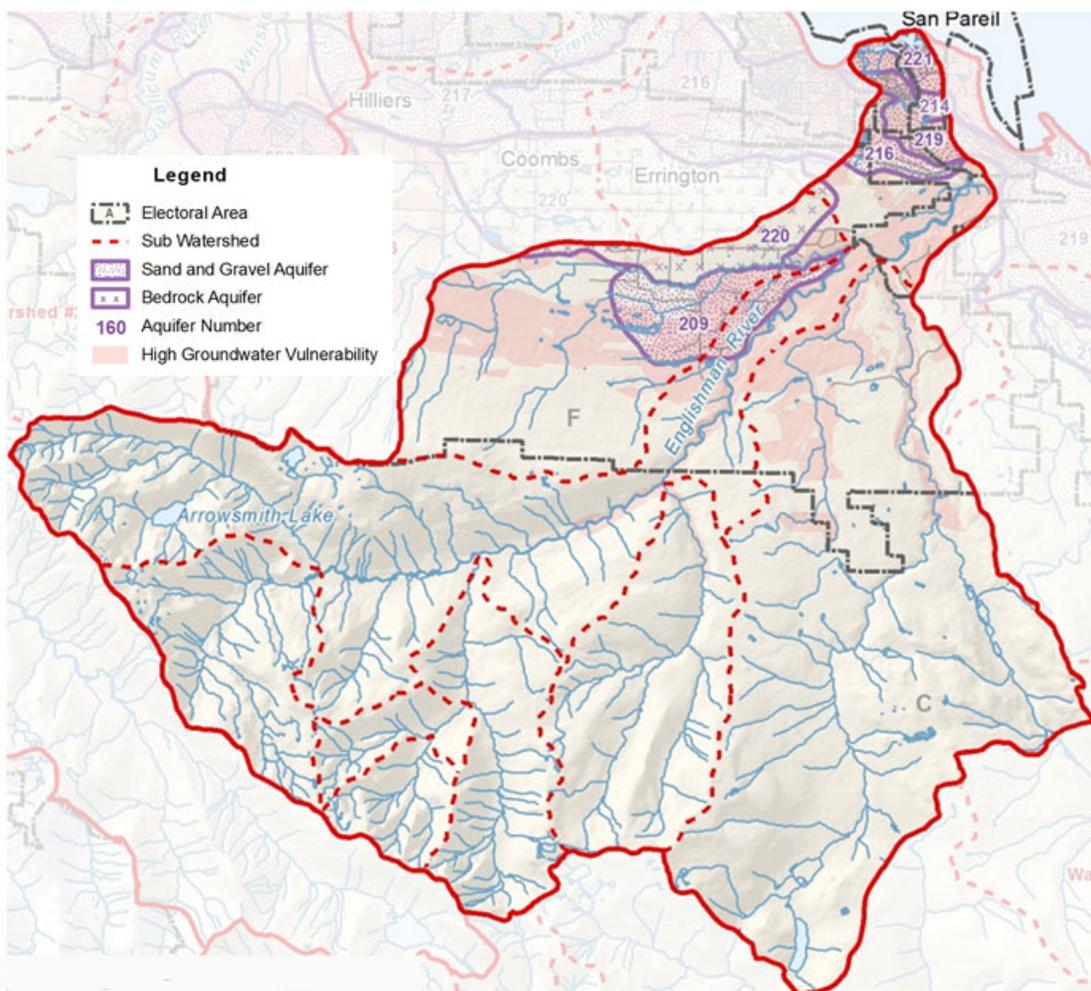
14.0 Watershed Protection Program

The Englishman River flows in an easterly direction from Mount Arrowsmith and discharges into the Strait of Georgia, north of Craig Bay. The highest elevation in the watershed is Mount Arrowsmith, at 1819 metres and this important watershed has a drainage area of 324 km².

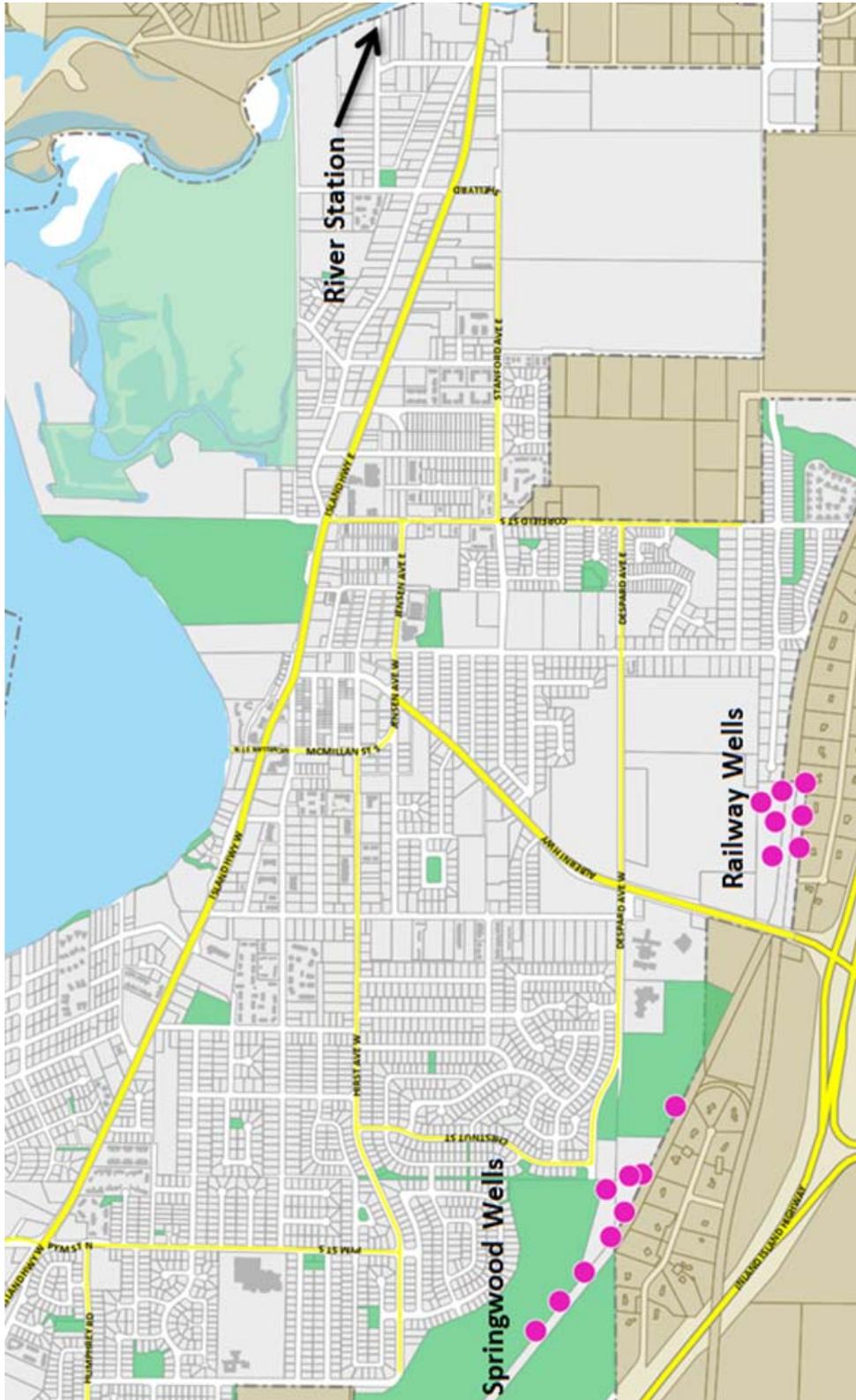
The South Englishman River, Swane Creek, Morison Creek, Shelly Creek and Centre Creek all drain into the Englishman River. The Englishman River is an important fisheries river and through the Arrowsmith Water Service, provides additional summer water supply for the City of Parksville and the Nanoose Peninsula. Water is stored behind a dam in Arrowsmith Lake and released as needed. Fish in the Englishman River include trout, steelhead and salmon. The Englishman River is identified as a 'sensitive stream' requiring special management attention under the Fisheries Protection Act. This is because of risk to fish populations due to inadequate water flows and other habitat concerns.

Several aquifers in this watershed area are showing signs of stress. Water levels in aquifers 216 and 220 have been dropping over the past several years. This means less water is available for rural residents who rely on wells for drinking water and less water is available in streams for fish. Surface water and groundwater are connected in this watershed, and in the summer when there is no rain, groundwater should be contributing base flow to the local rivers.

Unfortunately, dropping groundwater levels mean lower flows in streams and decreased fish health in the Englishman River and its tributaries.

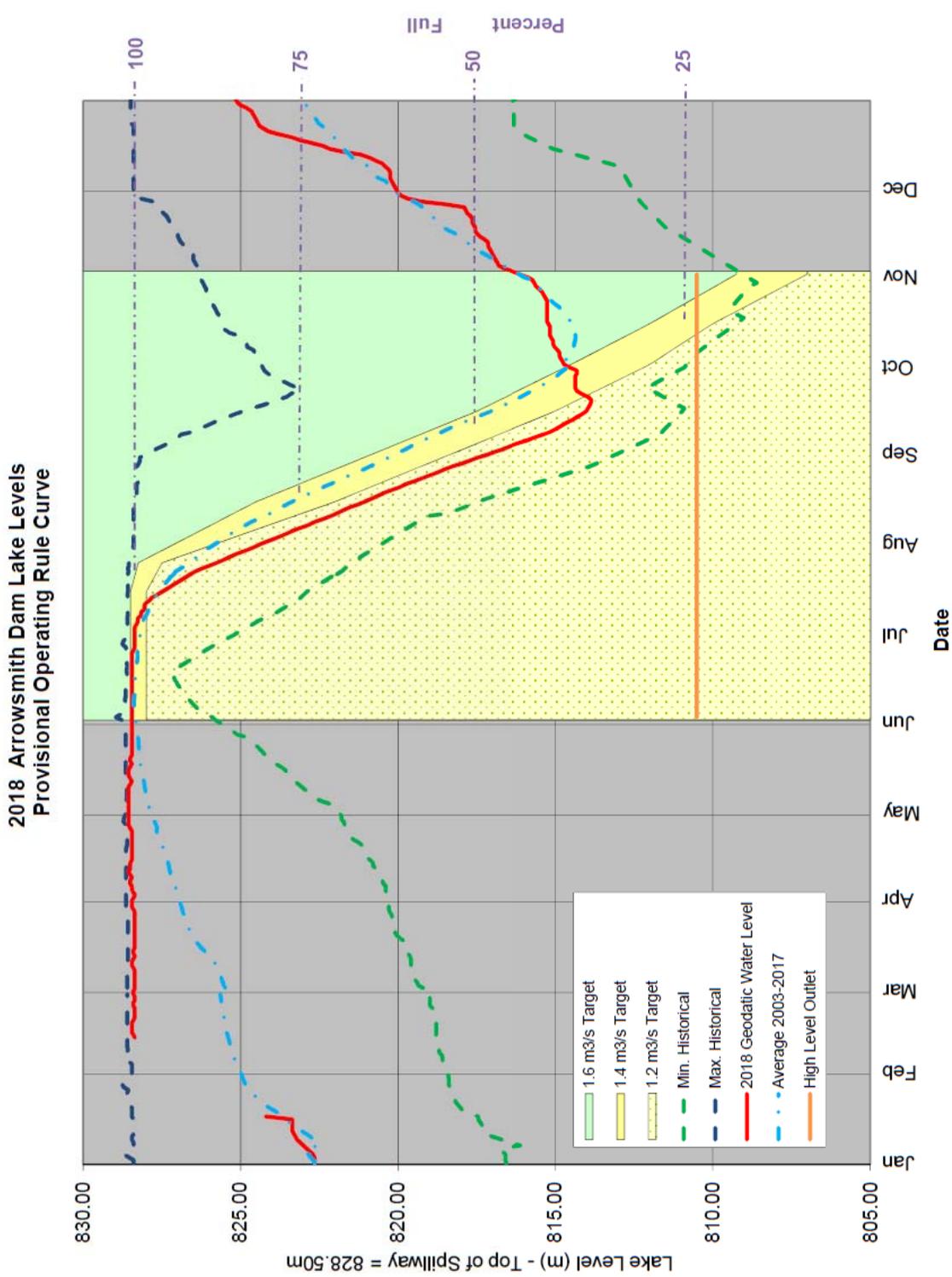


Appendix A



Water Source Locations Map

Appendix B



Current as of :2019-01-03

Prepared By: B. Silienieks

Arrowsmith Dam Lake Levels

Appendix C



Map of Pressure Zones (Yellow is High Pressure)

Appendix D

PARKSVILLE, WWS

Facility Location:

1116 Herring Gull Way
Parksville

Facility Information:

Facility Type: 301-10000 (DWT)

Facility Sampling History:

<u>Location</u>	<u>Date</u>	<u>Total Coliform</u>	<u>E. Coli</u>
851 TEMPLE (beside), 851 Temple	22-Jan-2019	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	22-Jan-2019	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	22-Jan-2019	L1	L1
Despard & Moilliet, 401 S. Moilliet Street, Parksville BC	22-Jan-2019	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	15-Jan-2019	L1	L1
across from 450 Wisteria, 450 Wisteria	15-Jan-2019	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	15-Jan-2019	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	15-Jan-2019	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	8-Jan-2019	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	8-Jan-2019	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	8-Jan-2019	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	8-Jan-2019	L1	L1
136 Memorial, 136 Memorial	18-Dec-2018	L1	L1
770 Soriel , 770 Soriel	18-Dec-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	18-Dec-2018	L1	L1
River Pump Station, Englishman River Intake	18-Dec-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	18-Dec-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	10-Dec-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	10-Dec-2018	L1	L1
851 TEMPLE (beside), 851 Temple	10-Dec-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	10-Dec-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	10-Dec-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	4-Dec-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	4-Dec-2018	L1	L1
Despard & Moilliet, 401 S. Moilliet Street, Parksville BC	4-Dec-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	4-Dec-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	4-Dec-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	4-Dec-2018	L1	L1
770 Soriel , 770 Soriel	28-Nov-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	28-Nov-2018	L1	L1
River Pump Station, Englishman River Intake	28-Nov-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	28-Nov-2018	L1	L1
136 Memorial, 136 Memorial	20-Nov-2018	L1	L1
851 TEMPLE (beside), 851 Temple	20-Nov-2018	L1	L1

Appendix D

Island Highway, by Temple, Island Highway, by Temple	20-Nov-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	20-Nov-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	13-Nov-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	13-Nov-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	13-Nov-2018	L1	L1
Despard & Moilliet, 401 S. Moilliet Street, Parksville BC	13-Nov-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	7-Nov-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	7-Nov-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	7-Nov-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	7-Nov-2018	L1	L1
136 Memorial, 136 Memorial	30-Oct-2018	L1	L1
770 Soriel , 770 Soriel	30-Oct-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	23-Oct-2018	L1	L1
Despard & Moilliet, 401 S. Moilliet Street, Parksville BC	23-Oct-2018	L1	L1
851 TEMPLE (beside), 851 Temple	16-Oct-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	16-Oct-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	16-Oct-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	16-Oct-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	10-Oct-2018	L1	L1
River Pump Station, Englishman River Intake	10-Oct-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	10-Oct-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	10-Oct-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	2-Oct-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	2-Oct-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	2-Oct-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	2-Oct-2018	L1	L1
136 Memorial, 136 Memorial	1-Oct-2018	L1	L1
851 TEMPLE (beside), 851 Temple	1-Oct-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	1-Oct-2018	L1	L1
River Pump Station, Englishman River Intake	1-Oct-2018	L1	L1
770 Soriel , 770 Soriel	18-Sep-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	18-Sep-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	18-Sep-2018	L1	L1
Despard & Moilliet, 401 S. Moilliet Street, Parksville BC	18-Sep-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	11-Sep-2018	A	
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	11-Sep-2018	A	
330 Park View, Parksville, 330 Park View, Parksville BC	9-Sep-2018	A	
across from 450 Wisteria, 450 Wisteria	9-Sep-2018	A	
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	4-Sep-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	4-Sep-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	4-Sep-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	4-Sep-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	28-Aug-2018	L1	L1

Appendix D

Community Park, Parksville BC, 193 East Island Highway, Parksville BC	28-Aug-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	28-Aug-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	28-Aug-2018	L1	L1
136 Memorial, 136 Memorial	21-Aug-2018	L1	L1
770 Soriel , 770 Soriel	21-Aug-2018	L1	L1
River Pump Station, Englishman River Intake	21-Aug-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	21-Aug-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	14-Aug-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	14-Aug-2018	L1	L1
851 TEMPLE (beside), 851 Temple	14-Aug-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	14-Aug-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	7-Aug-2018	L1	L1
Despard & Moilliet, 401 S. Moilliet Street, Parksville BC	7-Aug-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	7-Aug-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	7-Aug-2018	L1	L1
136 Memorial, 136 Memorial	31-Jul-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	31-Jul-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	31-Jul-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	24-Jul-2018	L1	L1
770 Soriel , 770 Soriel	24-Jul-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	24-Jul-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	17-Jul-2018	L1	L1
851 TEMPLE (beside), 851 Temple	17-Jul-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	17-Jul-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	10-Jul-2018	L1	L1
River Pump Station, Englishman River Intake	10-Jul-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	10-Jul-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	9-Jul-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	3-Jul-2018	L1	L1
Despard & Moilliet, 401 S. Moilliet Street, Parksville BC	3-Jul-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	3-Jul-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	3-Jul-2018	5	L1
136 Memorial, 136 Memorial	25-Jun-2018	L1	L1
770 Soriel , 770 Soriel	25-Jun-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	25-Jun-2018	L1	L1
River Pump Station, Englishman River Intake	25-Jun-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	19-Jun-2018	L1	L1
851 TEMPLE (beside), 851 Temple	19-Jun-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	19-Jun-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	19-Jun-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	12-Jun-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	12-Jun-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	12-Jun-2018	L1	L1

Appendix D

Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	12-Jun-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	5-Jun-2018	L1	L1
Despard & Moilliet, 401 S. Moiliet Street, Parksville BC	5-Jun-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	5-Jun-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	5-Jun-2018	L1	L1
136 Memorial, 136 Memorial	29-May-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	29-May-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	29-May-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	22-May-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	22-May-2018	L1	L1
River Pump Station, Englishman River Intake	22-May-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	16-May-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	16-May-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	16-May-2018	L1	L1
770 Soriel , 770 Soriel	8-May-2018	L1	L1
851 TEMPLE (beside), 851 Temple	8-May-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	8-May-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	1-May-2018	L1	L1
Despard & Moilliet, 401 S. Moiliet Street, Parksville BC	1-May-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	1-May-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	1-May-2018	L1	L1
136 Memorial, 136 Memorial	25-Apr-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	25-Apr-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	25-Apr-2018	L1	L1
River Pump Station, Englishman River Intake	25-Apr-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	17-Apr-2018	L1	L1
851 TEMPLE (beside), 851 Temple	17-Apr-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	17-Apr-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	17-Apr-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	10-Apr-2018	L1	L1
770 Soriel , 770 Soriel	10-Apr-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	10-Apr-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	10-Apr-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	3-Apr-2018	L1	L1
Despard & Moilliet, 401 S. Moiliet Street, Parksville BC	3-Apr-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	3-Apr-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	3-Apr-2018	L1	L1
136 Memorial, 136 Memorial	27-Mar-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	27-Mar-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	27-Mar-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	27-Mar-2018	L1	L1
River Pump Station, Englishman River Intake	27-Mar-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	20-Mar-2018	L1	L1
851 TEMPLE (beside), 851 Temple	20-Mar-2018	L1	L1

Appendix D

Wheeler, Top of Kingsley, 378 Kingsley Street	20-Mar-2018	L1	L1
770 Soriel , 770 Soriel	13-Mar-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	13-Mar-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	13-Mar-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	13-Mar-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	6-Mar-2018	L1	L1
Despard & Moilliet, 401 S. Moiliet Street, Parksville BC	6-Mar-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	6-Mar-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	6-Mar-2018	L1	L1
136 Memorial, 136 Memorial	27-Feb-2018	L1	L1
770 Soriel , 770 Soriel	27-Feb-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	27-Feb-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	27-Feb-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	20-Feb-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	20-Feb-2018	L1	L1
851 TEMPLE (beside), 851 Temple	20-Feb-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	20-Feb-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	13-Feb-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	13-Feb-2018	L1	L1
River Pump Station, Englishman River Intake	13-Feb-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	13-Feb-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	6-Feb-2018	L1	L1
Despard & Moilliet, 401 S. Moiliet Street, Parksville BC	6-Feb-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	6-Feb-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	6-Feb-2018	L1	L1
136 Memorial, 136 Memorial	30-Jan-2018	L1	L1
271 Chestnut Street, Parksville, 271 Chestnut Street, Parksville BC	30-Jan-2018	L1	L1
Island Highway, by Temple, Island Highway, by Temple	30-Jan-2018	L1	L1
770 Soriel , 770 Soriel	24-Jan-2018	L1	L1
Community Park, Parksville BC, 193 East Island Highway, Parksville BC	24-Jan-2018	L1	L1
Works Yard, Parksville, 1390 Herring Gull Way, Parksville BC	24-Jan-2018	L1	L1
330 Park View, Parksville, 330 Park View, Parksville BC	16-Jan-2018	L1	L1
851 TEMPLE (beside), 851 Temple	16-Jan-2018	L1	L1
Wheeler, Top of Kingsley, 378 Kingsley Street	16-Jan-2018	L1	L1
across from 450 Wisteria, 450 Wisteria	9-Jan-2018	L1	L1
Daffodil at Camas, Parksville, Daffodil at Camas, Parksville BC	9-Jan-2018	L1	L1
River Pump Station, Englishman River Intake	9-Jan-2018	L1	L1
613 Chinook Avenue, Parksville , 613 Chinook Avenue, Parksville BC	2-Jan-2018	L1	L1
Despard & Moilliet, 401 S. Moiliet Street, Parksville BC	2-Jan-2018	L1	L1
Parksville MHP/Utility Building, Parksville, 1247 Arbutus Road, Parksville BC	2-Jan-2018	L1	L1
Top of Corfield, Parksville , Harbour Homes, Parksville BC	2-Jan-2018	L1	L1

Information taken from: https://www.healthspace.ca/Clients/VIHA/VIHA_Website.nsf/Water-Samples-Frameset?OpenPage

Appendix E



CERTIFICATE OF ANALYSIS

REPORTED TO	Parksville, City of P O Box 1390, 100 Jensen Avenue East Parksville, BC V9P 2H3	WORK ORDER	8081843
ATTENTION	Barbara Silenieks	RECEIVED / TEMP REPORTED	2018-08-20 08:31 / 12°C
PO NUMBER	PO 003109	COC NUMBER	B72339
PROJECT	Drinking Water Pkg		
PROJECT INFO			

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO 17025:2005 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve



Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at hmaleki@caro.ca

Authorized By:

Helen Maleki, Dipl T
Client Service Representative

1-888-311-8846 | www.caro.ca

#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7

Full Spectrum Analysis

Appendix E



TEST RESULTS

REPORTED TO PROJECT Parkville, City of
Drinking Water Pkg

WORK ORDER REPORTED 8081843
2018-08-28 13:10

Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
River (8081843-01) Matrix: Water Sampled: 2018-08-20 09:15					
Anions					
Chloride	13.1	AO ≤ 250	0.10 mg/L	2018-08-23	
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	2018-08-23	
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	2018-08-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2018-08-23	
Sulfate	1.4	AO ≤ 500	1.0 mg/L	2018-08-23	
General Parameters					
Alkalinity, Total (as CaCO3)	26.6	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Bicarbonate (as CaCO3)	26.6	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Colour, True	< 5.0	AO ≤ 15	5.0 CU	2018-08-22	
Conductivity (EC)	96.7	N/A	2.0 µS/cm	2018-08-22	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2018-08-23	
pH	7.31	7.0-10.5	0.10 pH units	2018-08-22	HT2
Temperature, at pH	22.4	N/A	°C	2018-08-22	HT2
Turbidity	0.36	OG < 1	0.10 NTU	2018-08-22	
Calculated Parameters					
Hardness, Total (as CaCO3)	28.7	None Required	0.500 mg/L	N/A	
Langelier Index	-1.7	N/A	-5.0 -	2018-08-27	
Solids, Total Dissolved	46.9	AO ≤ 500	1.00 mg/L	N/A	
Total Metals					
Aluminum, total	0.0180	OG < 0.1	0.0050 mg/L	2018-08-25	
Antimony, total	< 0.00020	MAC = 0.006	0.00020 mg/L	2018-08-25	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050 mg/L	2018-08-25	
Barium, total	0.0067	MAC = 1	0.0050 mg/L	2018-08-25	
Boron, total	0.0225	MAC = 5	0.0050 mg/L	2018-08-25	
Cadmium, total	< 0.000010	MAC = 0.005	0.000010 mg/L	2018-08-25	
Calcium, total	9.29	None Required	0.20 mg/L	2018-08-25	
Chromium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2018-08-25	
Cobalt, total	< 0.00010	N/A	0.00010 mg/L	2018-08-25	
Copper, total	0.00099	AO ≤ 1	0.00040 mg/L	2018-08-25	
Iron, total	0.065	AO ≤ 0.3	0.010 mg/L	2018-08-25	
Lead, total	< 0.00020	MAC = 0.01	0.00020 mg/L	2018-08-25	
Magnesium, total	1.32	None Required	0.010 mg/L	2018-08-25	
Manganese, total	0.00578	AO ≤ 0.05	0.00020 mg/L	2018-08-25	
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2018-08-23	
Molybdenum, total	< 0.00010	N/A	0.00010 mg/L	2018-08-25	
Nickel, total	< 0.00040	N/A	0.00040 mg/L	2018-08-25	
Potassium, total	0.16	N/A	0.10 mg/L	2018-08-25	

Full Spectrum Analysis

Appendix E



TEST RESULTS

REPORTED TO PROJECT Parkville, City of
Drinking Water Pkg

WORK ORDER REPORTED 8081843
2018-08-28 13:10

Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
River (8081843-01) Matrix: Water Sampled: 2018-08-20 09:15, Continued					
<i>Total Metals, Continued</i>					
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2018-08-25	
Sodium, total	5.36	AO ≤ 200	0.10 mg/L	2018-08-25	
Strontium, total	0.0459	N/A	0.0010 mg/L	2018-08-25	
Uranium, total	< 0.000020	MAC = 0.02	0.000020 mg/L	2018-08-25	
Zinc, total	< 0.0040	AO ≤ 5	0.0040 mg/L	2018-08-25	
<i>Microbiological Parameters</i>					
Coliforms, Total	3900	MAC = 0	1 CFU/100 mL	2018-08-21	
E. coli	20	MAC = 0	1 CFU/100 mL	2018-08-21	
Springwood Well #5 (8081843-02) Matrix: Water Sampled: 2018-08-20 09:55					
<i>Anions</i>					
Chloride	18.9	AO ≤ 250	0.10 mg/L	2018-08-23	
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	2018-08-23	
Nitrate (as N)	1.82	MAC = 10	0.010 mg/L	2018-08-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2018-08-23	
Sulfate	7.8	AO ≤ 500	1.0 mg/L	2018-08-23	
<i>General Parameters</i>					
Alkalinity, Total (as CaCO3)	204	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Bicarbonate (as CaCO3)	204	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Colour, True	< 5.0	AO ≤ 15	5.0 CU	2018-08-22	
Conductivity (EC)	443	N/A	2.0 µS/cm	2018-08-22	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2018-08-23	
pH	7.62	7.0-10.5	0.10 pH units	2018-08-22	HT2
Temperature, at pH	22.5	N/A	°C	2018-08-22	HT2
Turbidity	0.69	OG < 1	0.10 NTU	2018-08-22	
<i>Calculated Parameters</i>					
Hardness, Total (as CaCO3)	179	None Required	0.500 mg/L	N/A	
Langelier Index	0.08	N/A	-5.0 -	2018-08-27	
Solids, Total Dissolved	236	AO ≤ 500	1.00 mg/L	N/A	
<i>Total Metals</i>					
Aluminum, total	< 0.0050	OG < 0.1	0.0050 mg/L	2018-08-25	
Antimony, total	< 0.00020	MAC = 0.006	0.00020 mg/L	2018-08-25	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050 mg/L	2018-08-25	
Barium, total	0.0107	MAC = 1	0.0050 mg/L	2018-08-25	
Boron, total	0.0196	MAC = 5	0.0050 mg/L	2018-08-25	

Full Spectrum Analysis

Appendix E



TEST RESULTS

REPORTED TO PROJECT Parksville, City of
Drinking Water Pkg

WORK ORDER REPORTED 8081843
2018-08-28 13:10

Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
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Springwood Well #5 (8081843-02) | Matrix: Water | Sampled: 2018-08-20 09:55, Continued

Total Metals, Continued

Cadmium, total	< 0.000010	MAC = 0.005	0.000010 mg/L	2018-08-25	
Calcium, total	38.4	None Required	0.20 mg/L	2018-08-25	
Chromium, total	0.00059	MAC = 0.05	0.00050 mg/L	2018-08-25	
Cobalt, total	< 0.00010	N/A	0.00010 mg/L	2018-08-25	
Copper, total	0.00335	AO ≤ 1	0.00040 mg/L	2018-08-25	
Iron, total	0.073	AO ≤ 0.3	0.010 mg/L	2018-08-25	
Lead, total	0.00050	MAC = 0.01	0.00020 mg/L	2018-08-25	
Magnesium, total	20.1	None Required	0.010 mg/L	2018-08-25	
Manganese, total	0.0381	AO ≤ 0.05	0.00020 mg/L	2018-08-25	
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2018-08-23	
Molybdenum, total	< 0.00010	N/A	0.00010 mg/L	2018-08-25	
Nickel, total	0.00043	N/A	0.00040 mg/L	2018-08-25	
Potassium, total	0.97	N/A	0.10 mg/L	2018-08-25	
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2018-08-25	
Sodium, total	17.8	AO ≤ 200	0.10 mg/L	2018-08-25	
Strontium, total	0.144	N/A	0.0010 mg/L	2018-08-25	
Uranium, total	0.000295	MAC = 0.02	0.000020 mg/L	2018-08-25	
Zinc, total	0.0062	AO ≤ 5	0.0040 mg/L	2018-08-25	

Microbiological Parameters

Coliforms, Total	<1	MAC = 0	1 CFU/100 mL	2018-08-21	
E. coli	<1	MAC = 0	1 CFU/100 mL	2018-08-21	

Springwood Well #10 (8081843-03) | Matrix: Water | Sampled: 2018-08-20 10:05

Anions

Chloride	17.1	AO ≤ 250	0.10 mg/L	2018-08-23	
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	2018-08-23	
Nitrate (as N)	1.12	MAC = 10	0.010 mg/L	2018-08-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2018-08-23	
Sulfate	10.6	AO ≤ 500	1.0 mg/L	2018-08-23	

General Parameters

Alkalinity, Total (as CaCO ₃)	109	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Bicarbonate (as CaCO ₃)	109	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Colour, True	< 5.0	AO ≤ 15	5.0 CU	2018-08-22	
Conductivity (EC)	279	N/A	2.0 µS/cm	2018-08-22	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2018-08-23	
pH	7.50	7.0-10.5	0.10 pH units	2018-08-22	HT2
Temperature, at pH	22.4	N/A	°C	2018-08-22	HT2

Full Spectrum Analysis

Appendix E



TEST RESULTS

REPORTED TO PROJECT Parkville, City of
Drinking Water Pkg

WORK ORDER REPORTED 8081843
2018-08-28 13:10

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
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Springwood Well #10 (8081843-03) | Matrix: Water | Sampled: 2018-08-20 10:05, Continued

General Parameters, Continued

Turbidity	< 0.10	OG < 1	0.10	NTU	2018-08-22	
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Calculated Parameters

Hardness, Total (as CaCO ₃)	119	None Required	0.500	mg/L	N/A	
Langelier Index	-0.5	N/A	-5.0	-	2018-08-27	
Solids, Total Dissolved	145	AO ≤ 500	1.00	mg/L	N/A	

Total Metals

Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2018-08-25	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2018-08-25	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2018-08-25	
Barium, total	0.0084	MAC = 1	0.0050	mg/L	2018-08-25	
Boron, total	0.0144	MAC = 5	0.0050	mg/L	2018-08-25	
Cadmium, total	< 0.000010	MAC = 0.005	0.000010	mg/L	2018-08-25	
Calcium, total	25.5	None Required	0.20	mg/L	2018-08-25	
Chromium, total	0.00077	MAC = 0.05	0.00050	mg/L	2018-08-25	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2018-08-25	
Copper, total	0.00215	AO ≤ 1	0.00040	mg/L	2018-08-25	
Iron, total	< 0.010	AO ≤ 0.3	0.010	mg/L	2018-08-25	
Lead, total	0.00028	MAC = 0.01	0.00020	mg/L	2018-08-25	
Magnesium, total	13.4	None Required	0.010	mg/L	2018-08-25	
Manganese, total	0.0195	AO ≤ 0.05	0.00020	mg/L	2018-08-25	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2018-08-23	
Molybdenum, total	0.00017	N/A	0.00010	mg/L	2018-08-25	
Nickel, total	0.00082	N/A	0.00040	mg/L	2018-08-25	
Potassium, total	0.53	N/A	0.10	mg/L	2018-08-25	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2018-08-25	
Sodium, total	6.81	AO ≤ 200	0.10	mg/L	2018-08-25	
Strontium, total	0.0977	N/A	0.0010	mg/L	2018-08-25	
Uranium, total	0.000079	MAC = 0.02	0.000020	mg/L	2018-08-25	
Zinc, total	0.0065	AO ≤ 5	0.0040	mg/L	2018-08-25	

Microbiological Parameters

Coliforms, Total	<1	MAC = 0	1	CFU/100 mL	2018-08-21	
E. coli	<1	MAC = 0	1	CFU/100 mL	2018-08-21	

Railway Well #2 (8081843-04) | Matrix: Water | Sampled: 2018-08-20 10:35

Anions

Chloride	48.6	AO ≤ 250	0.10	mg/L	2018-08-23	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2018-08-23	
Nitrate (as N)	1.38	MAC = 10	0.010	mg/L	2018-08-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2018-08-23	

Full Spectrum Analysis

Appendix E



TEST RESULTS

REPORTED TO PROJECT Parksville, City of
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Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
Railway Well #2 (8081843-04) Matrix: Water Sampled: 2018-08-20 10:35, Continued					
<i>Anions, Continued</i>					
Sulfate	6.3	AO ≤ 500	1.0 mg/L	2018-08-23	
<i>General Parameters</i>					
Alkalinity, Total (as CaCO ₃)	142	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Bicarbonate (as CaCO ₃)	142	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Colour, True	< 5.0	AO ≤ 15	5.0 CU	2018-08-22	
Conductivity (EC)	438	N/A	2.0 µS/cm	2018-08-22	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2018-08-23	
pH	7.67	7.0-10.5	0.10 pH units	2018-08-22	HT2
Temperature, at pH	22.5	N/A	°C	2018-08-22	HT2
Turbidity	0.25	OG < 1	0.10 NTU	2018-08-22	
<i>Calculated Parameters</i>					
Hardness, Total (as CaCO ₃)	183	None Required	0.500 mg/L	N/A	
Langelier Index	-0.03	N/A	-5.0 -	2018-08-27	
Solids, Total Dissolved	219	AO ≤ 500	1.00 mg/L	N/A	
<i>Total Metals</i>					
Aluminum, total	< 0.0050	OG < 0.1	0.0050 mg/L	2018-08-25	
Antimony, total	< 0.00020	MAC = 0.006	0.00020 mg/L	2018-08-25	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050 mg/L	2018-08-25	
Barium, total	0.0191	MAC = 1	0.0050 mg/L	2018-08-25	
Boron, total	0.0205	MAC = 5	0.0050 mg/L	2018-08-25	
Cadmium, total	0.000010	MAC = 0.005	0.000010 mg/L	2018-08-25	
Calcium, total	38.3	None Required	0.20 mg/L	2018-08-25	
Chromium, total	0.00107	MAC = 0.05	0.00050 mg/L	2018-08-25	
Cobalt, total	< 0.00010	N/A	0.00010 mg/L	2018-08-25	
Copper, total	0.00505	AO ≤ 1	0.00040 mg/L	2018-08-25	
Iron, total	0.273	AO ≤ 0.3	0.010 mg/L	2018-08-25	
Lead, total	0.00080	MAC = 0.01	0.00020 mg/L	2018-08-25	
Magnesium, total	21.2	None Required	0.010 mg/L	2018-08-25	
Manganese, total	0.0466	AO ≤ 0.05	0.00020 mg/L	2018-08-25	
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2018-08-23	
Molybdenum, total	< 0.00010	N/A	0.00010 mg/L	2018-08-25	
Nickel, total	0.00040	N/A	0.00040 mg/L	2018-08-25	
Potassium, total	0.81	N/A	0.10 mg/L	2018-08-25	
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2018-08-25	
Sodium, total	11.2	AO ≤ 200	0.10 mg/L	2018-08-25	
Strontium, total	0.136	N/A	0.0010 mg/L	2018-08-25	
Uranium, total	0.000368	MAC = 0.02	0.000020 mg/L	2018-08-25	

Full Spectrum Analysis

Appendix E



TEST RESULTS

REPORTED TO PROJECT Parksville, City of Drinking Water Pkg

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Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
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Railway Well #2 (8081843-04) | Matrix: Water | Sampled: 2018-08-20 10:35, Continued

Total Metals, Continued

Zinc, total	0.0076	AO ≤ 5	0.0040	mg/L	2018-08-25	
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Microbiological Parameters

Coliforms, Total	<1	MAC = 0	1	CFU/100 mL	2018-08-21	
E. coli	<1	MAC = 0	1	CFU/100 mL	2018-08-21	

Railway Well #5 (8081843-05) | Matrix: Water | Sampled: 2018-08-20 10:20

Anions

Chloride	32.5	AO ≤ 250	0.10	mg/L	2018-08-23	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2018-08-23	
Nitrate (as N)	2.19	MAC = 10	0.010	mg/L	2018-08-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2018-08-23	
Sulfate	7.8	AO ≤ 500	1.0	mg/L	2018-08-23	

General Parameters

Alkalinity, Total (as CaCO3)	127	N/A	1.0	mg/L	2018-08-22	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-08-22	
Alkalinity, Bicarbonate (as CaCO3)	127	N/A	1.0	mg/L	2018-08-22	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-08-22	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2018-08-22	
Colour, True	< 5.0	AO ≤ 15	5.0	CU	2018-08-22	
Conductivity (EC)	368	N/A	2.0	µS/cm	2018-08-22	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020	mg/L	2018-08-23	
pH	7.68	7.0-10.5	0.10	pH units	2018-08-22	HT2
Temperature, at pH	23.0	N/A		°C	2018-08-22	HT2
Turbidity	0.20	OG < 1	0.10	NTU	2018-08-22	

Calculated Parameters

Hardness, Total (as CaCO3)	150	None Required	0.500	mg/L	N/A	
Langelier Index	-0.1	N/A	-5.0	-	2018-08-27	
Solids, Total Dissolved	190	AO ≤ 500	1.00	mg/L	N/A	

Total Metals

Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2018-08-25	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2018-08-25	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2018-08-25	
Barium, total	0.0200	MAC = 1	0.0050	mg/L	2018-08-25	
Boron, total	0.0253	MAC = 5	0.0050	mg/L	2018-08-25	
Cadmium, total	< 0.000010	MAC = 0.005	0.000010	mg/L	2018-08-25	
Calcium, total	32.1	None Required	0.20	mg/L	2018-08-25	
Chromium, total	0.00076	MAC = 0.05	0.00050	mg/L	2018-08-25	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2018-08-25	

Full Spectrum Analysis

Appendix E



TEST RESULTS

REPORTED TO PROJECT Parksville, City of Drinking Water Pkg

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Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
Railway Well #5 (8081843-05) Matrix: Water Sampled: 2018-08-20 10:20, Continued					
Total Metals, Continued					
Copper, total	0.00655	AO ≤ 1	0.00040 mg/L	2018-08-25	
Iron, total	0.028	AO ≤ 0.3	0.010 mg/L	2018-08-25	
Lead, total	< 0.00020	MAC = 0.01	0.00020 mg/L	2018-08-25	
Magnesium, total	16.9	None Required	0.010 mg/L	2018-08-25	
Manganese, total	0.0149	AO ≤ 0.05	0.00020 mg/L	2018-08-25	
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2018-08-23	
Molybdenum, total	0.00016	N/A	0.00010 mg/L	2018-08-25	
Nickel, total	0.00053	N/A	0.00040 mg/L	2018-08-25	
Potassium, total	0.84	N/A	0.10 mg/L	2018-08-25	
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2018-08-25	
Sodium, total	12.7	AO ≤ 200	0.10 mg/L	2018-08-25	
Strontium, total	0.108	N/A	0.0010 mg/L	2018-08-25	
Uranium, total	0.000333	MAC = 0.02	0.000020 mg/L	2018-08-25	
Zinc, total	0.0043	AO ≤ 5	0.0040 mg/L	2018-08-25	
Microbiological Parameters					
Coliforms, Total	<1	MAC = 0	1 CFU/100 mL	2018-08-21	
E. coli	<1	MAC = 0	1 CFU/100 mL	2018-08-21	
Memorial (8081843-06) Matrix: Water Sampled: 2018-08-20 09:35					
Anions					
Chloride	13.8	AO ≤ 250	0.10 mg/L	2018-08-23	
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	2018-08-23	
Nitrate (as N)	0.023	MAC = 10	0.010 mg/L	2018-08-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2018-08-23	
Sulfate	1.4	AO ≤ 500	1.0 mg/L	2018-08-23	
General Parameters					
Alkalinity, Total (as CaCO3)	25.7	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Bicarbonate (as CaCO3)	25.7	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2018-08-22	
Colour, True	< 5.0	AO ≤ 15	5.0 CU	2018-08-22	
Conductivity (EC)	99.6	N/A	2.0 µS/cm	2018-08-22	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2018-08-23	
pH	7.25	7.0-10.5	0.10 pH units	2018-08-22	HT2
Temperature, at pH	22.9	N/A	°C	2018-08-22	HT2
Turbidity	0.23	OG < 1	0.10 NTU	2018-08-22	
Calculated Parameters					
Hardness, Total (as CaCO3)	30.3	None Required	0.500 mg/L	N/A	

Full Spectrum Analysis

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TEST RESULTS

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Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Memorial (8081843-06) Matrix: Water Sampled: 2018-08-20 09:35, Continued						
<i>Calculated Parameters, Continued</i>						
Langelier Index	-1.8	N/A	-5.0	-	2018-08-27	
Solids, Total Dissolved	47.9	AO ≤ 500	1.00	mg/L	N/A	
<i>Total Metals</i>						
Aluminum, total	0.0100	OG < 0.1	0.0050	mg/L	2018-08-25	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2018-08-25	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2018-08-25	
Barium, total	0.0070	MAC = 1	0.0050	mg/L	2018-08-25	
Boron, total	0.0186	MAC = 5	0.0050	mg/L	2018-08-25	
Cadmium, total	0.000012	MAC = 0.005	0.000010	mg/L	2018-08-25	
Calcium, total	9.81	None Required	0.20	mg/L	2018-08-25	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2018-08-25	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2018-08-25	
Copper, total	0.0646	AO ≤ 1	0.00040	mg/L	2018-08-25	
Iron, total	0.041	AO ≤ 0.3	0.010	mg/L	2018-08-25	
Lead, total	0.00077	MAC = 0.01	0.00020	mg/L	2018-08-25	
Magnesium, total	1.40	None Required	0.010	mg/L	2018-08-25	
Manganese, total	0.00107	AO ≤ 0.05	0.00020	mg/L	2018-08-25	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2018-08-23	
Molybdenum, total	0.00012	N/A	0.00010	mg/L	2018-08-25	
Nickel, total	0.00041	N/A	0.00040	mg/L	2018-08-25	
Potassium, total	0.15	N/A	0.10	mg/L	2018-08-25	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2018-08-25	
Sodium, total	5.51	AO ≤ 200	0.10	mg/L	2018-08-25	
Strontium, total	0.0480	N/A	0.0010	mg/L	2018-08-25	
Uranium, total	< 0.000020	MAC = 0.02	0.000020	mg/L	2018-08-25	
Zinc, total	0.0114	AO ≤ 5	0.0040	mg/L	2018-08-25	
<i>Microbiological Parameters</i>						
Coliforms, Total	<1	MAC = 0	1	CFU/100 mL	2018-08-21	
E. coli	<1	MAC = 0	1	CFU/100 mL	2018-08-21	

Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

Appendix E



APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO PROJECT Parksville, City of
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Analysis Description	Method Ref.	Technique	Location
Alkalinity in Water	SM 2320 B* (2011)	Titration with H2SO4	Kelowna
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Coliforms, Total in Water	SM 9222 (2006)	Membrane Filtration	Sublet
Colour, True in Water	SM 2120 C (2011)	Spectrophotometry (456 nm)	Kelowna
Conductivity in Water	SM 2510 B (2011)	Conductivity Meter	Kelowna
Cyanide, SAD in Water	ASTM D7511-12	Flow Injection with In-Line UV Digestion and Amperometry	Kelowna
E. coli in Water	SM 9223 B (2004)	Enzyme Substrate Endo Agar	Sublet
Hardness in Water	SM 2340 B* (2011)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	N/A
Langelier Index in Water	SM 2330 B (2010)	Calculation	N/A
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	Richmond
pH in Water	SM 4500-H+ B (2011)	Electrometry	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2011)	Calculation: $100 \times \frac{[Cations] - [Anions]}{[Cations] + [Anions]}$	N/A
Total Metals in Water	EPA 200.2* / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond
Turbidity in Water	SM 2130 B (2011)	Nephelometry	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
<1	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
°C	Degrees Celcius
AO	Aesthetic Objective
CFU/100 mL	Colony Forming Units per 100 millilitres
CU	Colour Units (referenced against a platinum cobalt standard)
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
OG	Operational Guideline (treated water)
pH units	pH < 7 = acidic, pH > 7 = basic
µS/cm	Microsiemens per centimetre
ASTM	ASTM International Test Methods
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Appendix E



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Parksville, City of
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The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk):** A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup):** An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS):** A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS):** A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM):** A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B8H1729									
Blank (B8H1729-BLK1) Prepared: 2018-08-22, Analyzed: 2018-08-22									
Chloride	< 0.10	0.10 mg/L							
Fluoride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Sulfate	< 1.0	1.0 mg/L							
Blank (B8H1729-BLK2) Prepared: 2018-08-23, Analyzed: 2018-08-23									
Chloride	< 0.10	0.10 mg/L							
Fluoride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Sulfate	< 1.0	1.0 mg/L							
LCS (B8H1729-BS1) Prepared: 2018-08-22, Analyzed: 2018-08-22									
Chloride	15.7	0.10 mg/L	16.0		98	90-110			
Fluoride	3.79	0.10 mg/L	4.00		95	88-108			
Nitrate (as N)	4.00	0.010 mg/L	4.00		100	93-108			
Nitrite (as N)	2.09	0.010 mg/L	2.00		105	85-114			
Sulfate	16.0	1.0 mg/L	16.0		100	91-109			
LCS (B8H1729-BS2) Prepared: 2018-08-23, Analyzed: 2018-08-23									
Chloride	16.2	0.10 mg/L	16.0		102	90-110			
Fluoride	3.69	0.10 mg/L	4.00		92	88-108			
Nitrate (as N)	4.07	0.010 mg/L	4.00		102	93-108			
Nitrite (as N)	2.08	0.010 mg/L	2.00		104	85-114			
Sulfate	16.0	1.0 mg/L	16.0		100	91-109			
General Parameters, Batch B8H1738									
Blank (B8H1738-BLK1) Prepared: 2018-08-22, Analyzed: 2018-08-22									
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0 mg/L							

Full Spectrum Analysis

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APPENDIX 2: QUALITY CONTROL RESULTS

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Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B8H1738, Continued									
Blank (B8H1738-BLK1), Continued					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Conductivity (EC)	< 2.0	2.0 µS/cm							
Blank (B8H1738-BLK2)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0 mg/L							
Conductivity (EC)	< 2.0	2.0 µS/cm							
LCS (B8H1738-BS1)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Alkalinity, Total (as CaCO3)	106	1.0 mg/L	100		106	92-106			
LCS (B8H1738-BS2)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Alkalinity, Total (as CaCO3)	106	1.0 mg/L	100		106	92-106			
LCS (B8H1738-BS3)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Conductivity (EC)	1400	2.0 µS/cm	1410		99	95-104			
LCS (B8H1738-BS4)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Conductivity (EC)	1410	2.0 µS/cm	1410		100	95-104			
Reference (B8H1738-SRM1)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
pH	6.99	0.10 pH units	7.01		100	98-102			HT2
Reference (B8H1738-SRM2)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
pH	6.96	0.10 pH units	7.01		99	98-102			HT2
General Parameters, Batch B8H1758									
Blank (B8H1758-BLK1)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Colour, True	< 5.0	5.0 CU							
LCS (B8H1758-BS1)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Colour, True	9.5	5.0 CU	10.0		95	85-115			
General Parameters, Batch B8H1759									
Blank (B8H1759-BLK1)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Turbidity	< 0.10	0.10 NTU							
LCS (B8H1759-BS1)					Prepared: 2018-08-22, Analyzed: 2018-08-22				
Turbidity	39.4	0.10 NTU	40.0		98	90-110			
General Parameters, Batch B8H1779									
Blank (B8H1779-BLK1)					Prepared: 2018-08-23, Analyzed: 2018-08-23				
Cyanide, Total	< 0.0020	0.0020 mg/L							
LCS (B8H1779-BS1)					Prepared: 2018-08-23, Analyzed: 2018-08-23				
Cyanide, Total	0.0199	0.0020 mg/L	0.0200		100	82-120			
LCS Dup (B8H1779-BSD1)					Prepared: 2018-08-23, Analyzed: 2018-08-23				
Cyanide, Total	0.0192	0.0020 mg/L	0.0200		96	82-120	4	10	

Full Spectrum Analysis

Appendix E



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO Parkville, City of
PROJECT Drinking Water Pkg

WORK ORDER 8081843
REPORTED 2018-08-28 13:10

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B8H1819									
Blank (B8H1819-BLK1)			Prepared: 2018-08-23, Analyzed: 2018-08-23						
Mercury, total	< 0.000010	0.000010 mg/L							
Blank (B8H1819-BLK2)			Prepared: 2018-08-23, Analyzed: 2018-08-23						
Mercury, total	< 0.000010	0.000010 mg/L							
Duplicate (B8H1819-DUP1)			Source: 8081843-01		Prepared: 2018-08-23, Analyzed: 2018-08-23				
Mercury, total	< 0.000010	0.000010 mg/L		< 0.000010			20		
Matrix Spike (B8H1819-MS1)			Source: 8081843-02		Prepared: 2018-08-23, Analyzed: 2018-08-23				
Mercury, total	0.000235	0.000010 mg/L		0.000250	< 0.000010	94	70-130		
Reference (B8H1819-SRM1)			Prepared: 2018-08-23, Analyzed: 2018-08-23						
Mercury, total	0.00543	0.000010 mg/L		0.00489		111	80-120		
Reference (B8H1819-SRM2)			Prepared: 2018-08-23, Analyzed: 2018-08-23						
Mercury, total	0.00446	0.000010 mg/L		0.00489		91	80-120		
Total Metals, Batch B8H1945									
Blank (B8H1945-BLK1)			Prepared: 2018-08-24, Analyzed: 2018-08-25						
Aluminum, total	< 0.0050	0.0050 mg/L							
Antimony, total	< 0.00020	0.00020 mg/L							
Arsenic, total	< 0.00050	0.00050 mg/L							
Barium, total	< 0.0050	0.0050 mg/L							
Boron, total	< 0.0050	0.0050 mg/L							
Cadmium, total	< 0.000010	0.000010 mg/L							
Calcium, total	< 0.20	0.20 mg/L							
Chromium, total	< 0.00050	0.00050 mg/L							
Cobalt, total	< 0.00010	0.00010 mg/L							
Copper, total	< 0.00040	0.00040 mg/L							
Iron, total	< 0.010	0.010 mg/L							
Lead, total	< 0.00020	0.00020 mg/L							
Magnesium, total	< 0.010	0.010 mg/L							
Manganese, total	< 0.00020	0.00020 mg/L							
Molybdenum, total	< 0.00010	0.00010 mg/L							
Nickel, total	< 0.00040	0.00040 mg/L							
Potassium, total	< 0.10	0.10 mg/L							
Selenium, total	< 0.00050	0.00050 mg/L							
Sodium, total	< 0.10	0.10 mg/L							
Strontium, total	< 0.0010	0.0010 mg/L							
Uranium, total	< 0.000020	0.000020 mg/L							
Zinc, total	< 0.0040	0.0040 mg/L							
LCS (B8H1945-BS1)			Prepared: 2018-08-24, Analyzed: 2018-08-25						
Aluminum, total	0.0240	0.0050 mg/L	0.0200		120	80-120			
Antimony, total	0.0210	0.00020 mg/L	0.0200		105	80-120			
Arsenic, total	0.0210	0.00050 mg/L	0.0200		105	80-120			
Barium, total	0.0204	0.0050 mg/L	0.0200		102	80-120			
Boron, total	0.0229	0.0050 mg/L	0.0200		114	80-120			
Cadmium, total	0.0206	0.000010 mg/L	0.0200		103	80-120			
Calcium, total	1.93	0.20 mg/L	2.00		97	80-120			
Chromium, total	0.0213	0.00050 mg/L	0.0200		106	80-120			
Cobalt, total	0.0216	0.00010 mg/L	0.0200		108	80-120			
Copper, total	0.0223	0.00040 mg/L	0.0200		112	80-120			
Iron, total	1.91	0.010 mg/L	2.00		96	80-120			
Lead, total	0.0214	0.00020 mg/L	0.0200		107	80-120			

Full Spectrum Analysis

Appendix E



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Parkville, City of
Drinking Water Pkg

WORK ORDER REPORTED 8081843
2018-08-28 13:10

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B8H1945, Continued									
LCS (B8H1945-BS1), Continued					Prepared: 2018-08-24, Analyzed: 2018-08-25				
Magnesium, total	2.04	0.010 mg/L	2.00		102	80-120			
Manganese, total	0.0205	0.00020 mg/L	0.0200		103	80-120			
Molybdenum, total	0.0210	0.00010 mg/L	0.0200		105	80-120			
Nickel, total	0.0215	0.00040 mg/L	0.0200		107	80-120			
Potassium, total	1.89	0.10 mg/L	2.00		94	80-120			
Selenium, total	0.0201	0.00050 mg/L	0.0200		101	80-120			
Sodium, total	2.08	0.10 mg/L	2.00		104	80-120			
Strontium, total	0.0209	0.0010 mg/L	0.0200		104	80-120			
Uranium, total	0.0212	0.000020 mg/L	0.0200		106	80-120			
Zinc, total	0.0214	0.0040 mg/L	0.0200		107	80-120			
Duplicate (B8H1945-DUP1)									
Source: 8081843-01					Prepared: 2018-08-24, Analyzed: 2018-08-25				
Aluminum, total	0.0174	0.0050 mg/L	0.0180						20
Antimony, total	< 0.00020	0.00020 mg/L	< 0.00020						20
Arsenic, total	< 0.00050	0.00050 mg/L	< 0.00050						15
Barium, total	0.0070	0.0050 mg/L	0.0067						9
Boron, total	0.0251	0.0050 mg/L	0.0225				11		20
Cadmium, total	< 0.000010	0.000010 mg/L	0.000010						20
Calcium, total	9.39	0.20 mg/L	9.29				1		12
Chromium, total	< 0.00050	0.00050 mg/L	< 0.00050						12
Cobalt, total	< 0.00010	0.00010 mg/L	< 0.00010						13
Copper, total	0.00110	0.00040 mg/L	0.00099						20
Iron, total	0.067	0.010 mg/L	0.065				3		18
Lead, total	< 0.00020	0.00020 mg/L	< 0.00020						20
Magnesium, total	1.35	0.010 mg/L	1.32						10
Manganese, total	0.00586	0.00020 mg/L	0.00578				1		13
Molybdenum, total	0.00010	0.00010 mg/L	< 0.00010						20
Nickel, total	< 0.00040	0.00040 mg/L	< 0.00040						20
Potassium, total	0.16	0.10 mg/L	0.16						13
Selenium, total	< 0.00050	0.00050 mg/L	< 0.00050						20
Sodium, total	5.43	0.10 mg/L	5.36						10
Strontium, total	0.0470	0.0010 mg/L	0.0459				2		9
Uranium, total	< 0.000020	0.000020 mg/L	< 0.000020						14
Zinc, total	< 0.0040	0.0040 mg/L	< 0.0040						8
Reference (B8H1945-SRM1)									
Prepared: 2018-08-24, Analyzed: 2018-08-25									
Aluminum, total	0.318	0.0050 mg/L	0.303		105	82-114			
Antimony, total	0.0516	0.00020 mg/L	0.0511		101	88-115			
Arsenic, total	0.122	0.00050 mg/L	0.118		103	88-111			
Barium, total	0.791	0.0050 mg/L	0.823		96	83-110			
Boron, total	3.25	0.0050 mg/L	3.45		94	80-118			
Cadmium, total	0.0490	0.000010 mg/L	0.0495		99	90-110			
Calcium, total	10.4	0.20 mg/L	11.6		89	85-113			
Chromium, total	0.265	0.00050 mg/L	0.250		106	88-111			
Cobalt, total	0.0408	0.00010 mg/L	0.0377		108	90-114			
Copper, total	0.528	0.00040 mg/L	0.486		109	90-117			
Iron, total	0.467	0.010 mg/L	0.488		96	90-116			
Lead, total	0.209	0.00020 mg/L	0.204		102	90-110			
Magnesium, total	3.82	0.010 mg/L	3.79		101	88-116			
Manganese, total	0.108	0.00020 mg/L	0.109		99	88-108			
Molybdenum, total	0.201	0.00010 mg/L	0.198		101	88-110			
Nickel, total	0.260	0.00040 mg/L	0.249		104	90-112			
Potassium, total	6.71	0.10 mg/L	7.21		93	87-116			
Selenium, total	0.120	0.00050 mg/L	0.121		99	90-122			
Sodium, total	7.47	0.10 mg/L	7.54		99	86-118			
Strontium, total	0.382	0.0010 mg/L	0.375		102	86-110			

Full Spectrum Analysis

Appendix E



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Parksville, City of Drinking Water Pkg

WORK ORDER REPORTED 8081843 2018-08-28 13:10

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<i>Total Metals, Batch B8H1945, Continued</i>									
Reference (B8H1945-SRM1), Continued					Prepared: 2018-08-24, Analyzed: 2018-08-25				
Uranium, total	0.0305	0.000020 mg/L	0.0306		100	88-112			
Zinc, total	2.42	0.0040 mg/L	2.49		97	90-113			

QC Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

Appendix F

2018	Community Park				Temple			
	March	May	August	November	March	May	August	November
Total THM (mg/L)	0.00762	0.0083	0.0158	0.0237	0.0051	0.01	0.00869	0.00733
Bromodichloromethanes (mg/L)	0.002	0.0018	0.0024	0.0065	0.0014	0.0023	0.002	0.0021
Bromoform (mg/L)	0.0013	0.0011	<0.001	0.0023	0.0012	0.0011	0.0016	0.0017
Chloroform (mg/L)	0.0012	0.0029	0.0133	0.0082	<0.001	0.0037	0.0023	<0.001
Dibromochloromethane (mg/L)	0.0032	0.0025	<0.001	0.0066	0.0024	0.0028	0.0029	0.0036
Toluene-d8 (%)	113	120	76	77	106	120	75	75
4-Bromofluorobenzene (%)	99	63	90	75	92	63	91	82
2018	Ermineskin				Public Works			
	March	May	August	November	March	May	August	November
Total THM (mg/L)	0.00461	<0.004	<0.004	0.00506	0.00669	0.0436	0.0219	0.0159
Bromodichloromethanes (mg/L)	0.0012	<0.001	<0.001	0.0013	0.0017	0.0016	0.0038	0.0043
Bromoform (mg/L)	0.0012	<0.001	0.0011	0.0014	0.0012	<0.001	<0.001	0.0023
Chloroform (mg/L)	<0.001	<0.001	<0.001	<0.001	0.001	0.0419	0.0182	0.0037
Dibromochloromethane (mg/L)	0.0022	0.0015	0.0016	0.0024	0.0028	<0.001	<0.001	0.0056
Toluene-d8 (%)	118	119	77	70	105	119	74	77
4-Bromofluorobenzene (%)	105	63	92	70	91	63	83	76

THM Analysis

Appendix G



CITY OF PARKSVILLE
MAR 02 2016
OPERATIONS
HEALTH PROTECTION

PERMIT to OPERATE

A WATER SUPPLY SYSTEM
A Drinking Water System with 301- 10.000 connections

Water System Name: PARKSVILLE, WWS
Premises Number: 1310814
Premises Address: 1116 Herring Gull Way
Parksville, BC
V9P 2H3
Water System Owner: City of Parksville

City of Parksville is hereby permitted to operate the above potable water supply system and is required to operate this system in accordance with the Drinking Water Protection Act and in accordance with the conditions set out in this operating permit and conditions established as part of any construction permit.

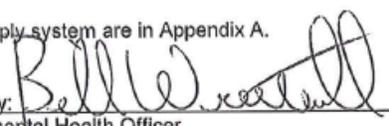
The water supply system for which this operating permit applies is generally described as:

Service Delivery Area: Englishman River Water Service Area
Source Water: Multiple wells & Englishman River (May to October)
Water Treatment methods are: None
Water Disinfection methods are: Chlorination (liquid & gas).

Number of Connections 301-10,000 Connections - DWT

Operating conditions specific to this water supply system are in Appendix A.

Date: July 1, 1992

Issued By: 
Environmental Health Officer

This permit must be displayed
in a conspicuous place and is not transferable

Place Decal Here

Water System Operating Conditions

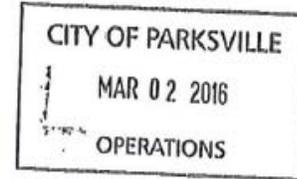
Appendix G

Excellent health and care for everyone,
everywhere, everytime.



March 1, 2016

Mike Squire
Program Manager
Englishman River Water Service
1116 Herring Gull Way
PO Box 1390
Parksville, BC V9P 2H3



Dear Mike:

**Re: Changes to Terms and Conditions of the City of Parksville Water System
Operating Permit**

Please find enclosed an amended operating permit issued under section 8(4) of the *Drinking Water Protection Act* (the "Act"). The terms and conditions are attached as Appendix A (Operational) and Appendix B (Surface Water Treatment Objectives) and are effective **March 1, 2016**.

The terms and conditions, Appendix A dated April, 2009 is hereby rescinded.

In accordance to section 8(1)(b) of the Act, the water supply system must be operated in accordance with these terms and conditions. It is understood that Appendix B timeframes are target dates. Large construction projects may encounter unforeseen delays which may prohibit the completion of the project by the listed dates.

Upon completion of the water treatment plant, this proposed permit will have to be amended to reflect the new works. At that time the City of Parksville will have to request an amendment to their Operating Permit. For example, performance standards for the selected filtration technology would be listed on the Operating Permit but are not reflected in this Permit.

Please also note that water suppliers have various responsibilities under the Act and the *Drinking Water Protection Regulation* (The "Regulation"), beyond those set out as terms and conditions of the operating permit. It is your responsibility to familiarize yourself with the Act and Regulations. See section 2.2 of part A of the *Drinking Water Officer's Guide* for a summary of responsibilities and references to some of the relevant provisions of the Act and Regulation. This is intended for basic information purposes only.

If you have any questions about this operating permit, please do not hesitate to contact me at (250) 947.8222 or by email at bill.wrathall@viha.ca

Health Protection and Environmental Services
489 Alberni Highway, Parksville, BC V9P 1J9

Phone: 250-947-8222
Fax: 250-951-9576

Water System Operating Conditions

Appendix G

March 1, 2016

Appendix A - Operational

Water System Operating Permit Terms and Conditions For the Current City of Parksville Water System

The permit holder is advised the following Terms and Conditions are in addition to other legislated responsibilities and obligations such as:

- The Drinking Water Protection Act, ([SBC 2001] Chapter 9
 - The Drinking Water Protection Regulation (B.C. Reg. 200/2003 O.C. 508/2003)
1. Adhere to monitoring requirements to ensure the efficacy of disinfection and/or treatment technology. Provide a minimum of 0.2 mg/L of residual disinfectant, measured as *free* chlorine for the water entering the system. The level of residual disinfectant at any point within the distribution system should be at least 0.05 mg/L, measured as *total or free* chlorine.

If detectable levels of chlorine are not observed during routine residual analysis in the distribution system, the water supplier shall obtain water samples and have them analyzed for total coliform and *Escherichia coli*, and undertake any necessary steps to return a chlorine residual as *total* and *free* chlorine.
 2. Provide continuous on-line turbidity monitoring of raw water for the Englishman River during drawing periods (May through October or as applicable) to ensure less than or equal to 1 NTU of turbidity in finished water. Ensure the Emergency Response Plan includes appropriate action for turbidity events as detailed in the "*Decision Tree for Responding to a Turbidity Event in Unfiltered Drinking Water*".
 3. Routine surveillance and evaluation of a source water protection program and emergency response plan to identify and respond to any activity that may impact or cause changes to the source water.
 4. Adhere to a sampling program as approved by the Drinking Water Officer and according to BCWWA standards or equivalent. Maintain records of all monitoring conducted. The sampling program is to include, but is not necessarily limited to, the following:
 - Bacteriological testing at representative locations within the distribution system.
 - Chemical testing in accordance with the *Guidelines Canadian Drinking Water Quality* or parameters specified in the *VIHA Guidelines for Approval of Water Supply Systems*.
 - Chlorine disinfectant concentration testing at representative locations within the distribution system.
 5. Adhere to maintenance and operating procedures as approved by the Drinking Water Officer and abide by BCWWA standards or equivalent. Maintenance and operating procedures shall address but is not necessarily limited to:
 - Source water and intake protection.

Appendix G

March 1, 2016

Appendix B – Surface Water Treatment Objectives

Water System Operating Permit Terms and Conditions For City of Parksville Water System

The permit holder is advised the following Terms and Conditions are in addition to other legislated responsibilities and obligations such as:

- The *Drinking Water Protection Act*, ([SBC 2001] Chapter 9
- The *Drinking Water Protection Regulation* (B.C. Reg. 200/2003 O.C. 508/2003)

-
1. Englishman River water source must be treated in accordance with the *Drinking Water Treatment Objectives (Microbiological) for Surface Water Systems in British Columbia* to achieve the following performance standard:
 - 4-log reduction or inactivation of viruses.
 - 3-log reduction or inactivation of *Giardia* and *Cryptosporidium*.
 - Two treatment processes for surface water.
 - Less than or equal to one (1) nephelometric turbidity unit (NTU) of turbidity in finished water.
 2. Establish an implementation strategy towards meeting the SWTO's with a projected water treatment plant operational date by September 30, 2018. The following timeframes and critical objectives are identified:
 - December 1, 2016 - Submission of construction permit application(s) for the water treatment plant, intake, pump station and transmission mains.
 - March 31, 2017 - Construction commencement.
 - June 30, 2018 - Construction complete.
 - July 1, 2018 - Commissioning commences.
 - September 30, 2018 - Plant operational.

If unforeseen and/or extenuating circumstances prevent completion of the water treatment plant by September 30, 2018 the water supplier must notify the Environmental Health Officer (EHO), a minimum of 90 days in advance of the deadline, and provide rationale for the delay. Any changes to the operating permit must be approved by the EHO in writing.

3. Provide formal project updates by the following dates:
 - July 29, 2016.
 - January 27, 2017.
 - July 28, 2017.
 - January 31, 2018.

* Project updates may be written or in presentation format.